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Case Report

A rare case report: isolated midbrain lacunar infarct affecting the ipsilateral medial longitudinal fasciculus causing internuclear ophthalmoplegia effect

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ABSTRACT

Isolated medial longitudinal fasciculus infarct is rare and can also be associated with cranial nerve nuclei or extra-nuclear regions leading to respective neurological deficit. We report a case of 73-year-old woman presenting with a 24 hour of confusion, abnormal eye movement and unsteady gait on a background history of uncontrolled diabetes mellitus (DM), hypertension and Alzheimer's disease. Her examination found to have dysdiadokinesia in left upper limb and inability to adduct right eyeball on left lateral gaze, without affecting the pupil. She was not oriented to time and place while before this event she could. Her examination found to have normal power in limbs and sensation. Her computed tomography (CT) brain showed no evidence of acute infarction or intracranial bleed. Magnetic resonance imaging (MRI) brain demonstrated acute lacunar infarct involving the ipsilateral medial longitudinal fasciculus. This case demonstrates rare brainstem infarct affecting medial longitudinal fasciculus region below the IIIrd cranial nerve nucleus giving features of internuclear ophthalmoplegia affecting medial rectus muscle without affecting autonomic fibres of IIIrd cranial nerve due to which the pupil is not affected. We recommend strict control of predisposing conditions, mainly diabetes and hypertension to reduce the incidence of brainstem stroke.

Keywords: Medial longitudinal fasciculus infarct, Extra-ocular muscle paralysis, Internuclear ophthalmoplegia, Ischemic stroke, Cerebrovascular vascular accident

INTRODUCTION

Loss of balance, confusion and abnormal eye movement can be due to many differentials in an elderly person with Alzheimer's disease, diabetes mellitus (DM) and hypertension. One of the causes for this presentation is cerebrovascular accident (CVA). Involvement of eye movement in CVA suggest possibility of 3rd, 4th and or 6th cranial nerve involvement and the lesion being at the brainstem level.[1] Ischemia is a commonest cause for the infarcts at brainstem level. The risk factors for ischemia include DM, hypertension, dyslipidemia, smoking, physical inactivity, auto-immune disorders, increasing age and more.[2] Medial longitudinal fasciculus is a tract in the brainstem carrying the nerve fibres. It has ascending and descending tracts. The ascending tracts contributed by 4 vestibular nuclei and the descending fibres from medial vestibular nuclei.[3] The tract links VIIIth cranial nerve and the 3 nerves supplying the extra-ocular muscles IIIrd, IVth and VIth cranial nerves. The involvement of the medial longitudinal fasciculus (MLF) can cause paralysis of these nerve regions. Internuclear ophthalmoplegia (INO) is an abnormal ocular movement phenomenon which presents with ipsilateral eyeball adduction difficulty and contralateral nystagmus. The presence of INO indicates the possibility of infarct at the level of brainstem.[4] This can be caused by all the conditions causing CVA as mentioned but

is also seen in cases of multiple sclerosis, vascular lesions, tumours, infections, vasculitis, injury and more.[5]

Early recognition and appropriate management of the predisposing factors to CVA including diabetes reduces the incidence of CVA and improves both the morbidity and the mortality. Management of the ischemic stroke (including that of brainstem infarct) includes neurological assessment, imaging of brain, medical management depending on presentation, treatment of predisposing risk factors and rehabilitation.[6] Complications of brainstem CVA which include neurological deficit could be short or long term, but majority of patients presenting with INO spontaneously improve over time.[4] We present a case of medial longitudinal fasciculus infarction with internuclear ophthalmoplegia phenomenon.

CASE REPORT

A 73-year female patient with a background history of DM, hypertension and early Alzheimer's disease presented with sudden onset dizziness and unsteady gait over past 24 hours. Patient's daughter also noted that her right eye was not moving fully.

Her regular medication included Amlodipine, Placida (Flupenthixitol 0.5 mg and melitracen 10 mg), Donepezil, Pacitane (Trihexyphenidyl) and gliclazide.

On examination, she was afebrile, with blood pressure of 165/90 and pulse rate of 115 bpm. She had ataxic gait with normal motor power of 5/5 in all limbs and sensation to touch and pin prick. She could walk with the support of one assistant and her speech was normal. she was not aware of the time and place while previously she could.

On cranial nerve examination, she had right medial rectus muscle palsy with inability to move right eyeball fully medially (Figures 1a-c). Her pupil was 3 mm dilated on both sides, reacting to light and of regular shape. She had no other cranial nerve palsies.

She displayed intentional tremor and dysdiadokokinesia in her left upper limb.

She was transferred to the emergency department at a secondary care hospital for further management.

Treatment

Patient was admitted at the hospital, blood glucose level was controlled with insulin on sliding scale, Aspirin and statin was started after CT/MRI scan, prophylactic enoxaparin was given during the stay.

Patient received physiotherapy and occupational therapy assessment during her stay and discharged on the 4th day with follow up appointment at Stroke Clinic.

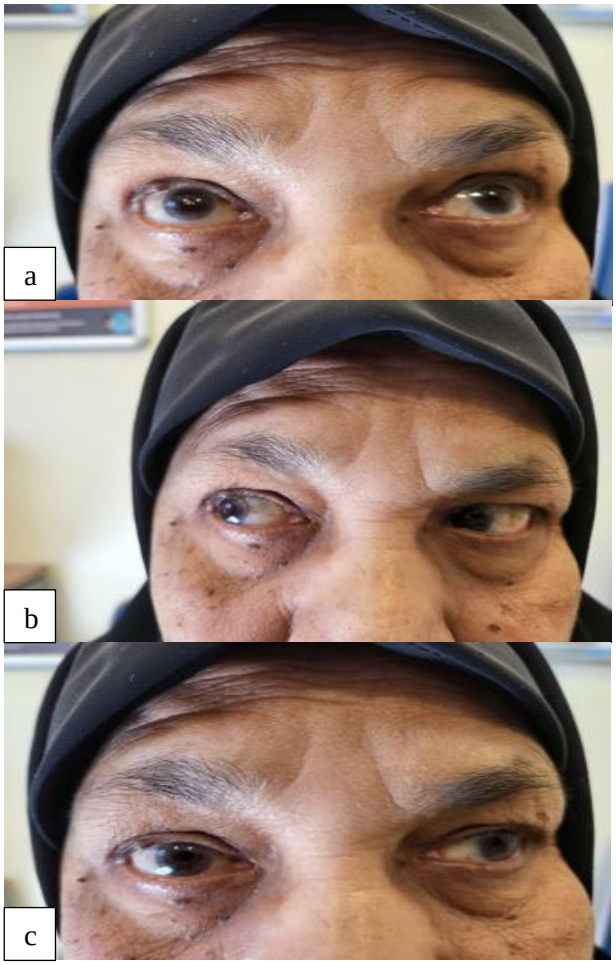

Figure 1 (a-c): Right medial rectus muscle palsy with inability to move right eyeball fully medially.

Investigations

Blood investigations showed normal full blood count, renal function, liver function, calcium, and lipid levels. Her HbA1c was 11.6% (103 mmol/mol).

Electrocardiography (ECG) showed sinus rhythm without any acute ST-T wave changes.

CT brain scan reported as age related parenchymal volume loss. Periventricular and subcortical white matter hypodensities in both hemispheres in keeping with chronic ischemic microvascular disease. No evidence of acute infarction or intracranial bleed.

MRI diffusion weighted imaging – initially reported as tiny acute diffusion restricting lacunar infarct, seen in the right posteromedial aspect of the brainstem at the Ponto mesencephalic junction. On further request, more information provided by the radiologist to be the lacunar infarct involving the ipsilateral medial longitudinal fasciculus in the brainstem at the brainstem-pontine junction below the level of 3rd nerve nucleus, also probably involving the adjacent trochlear nerve (4th cranial nerve) nucleus (Figures 2 and 3).

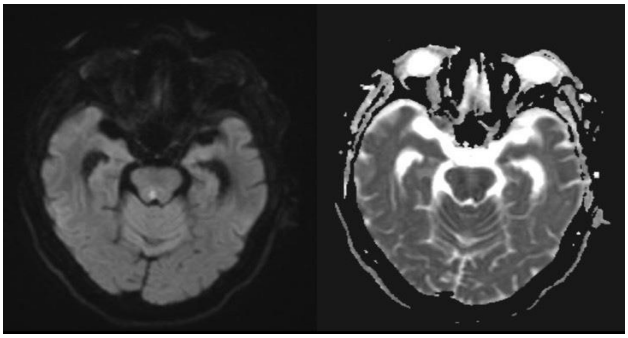

Figure 2: Axial diffusion-weighted imaging with corresponding.

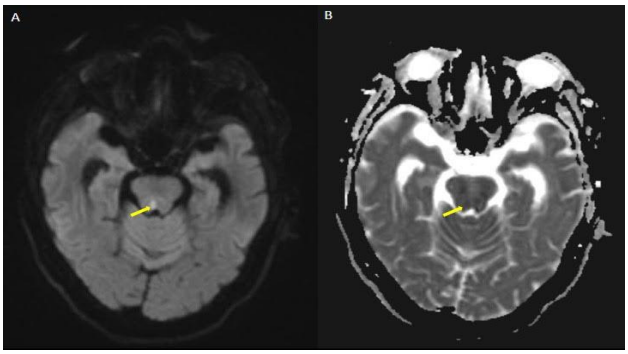

Figure 3: Apparent diffusion coefficient sequence showing lacunar infarct (yellow arrows).

US doppler of the carotid artery showed tiny calcified plaques at both carotid bulbs.

Holter monitor and echocardiogram showed no significant abnormality.

Diagnosis

Cerebrovascular infarct involving medial longitudinal fasciculus in midbrain with feature of internuclear ophthalmoplegia.

Outcome and follow-up

Patient was a family visitor to the country and has not managed to attend the stroke clinic on their follow up appointment.

DISCUSSION

The mild symptoms of loss of balance, dizziness, and confusion with which the patient presented provides large differentials. Initial clinical assessment and investigations narrow it down to CVA. Presence of isolated medial rectus palsy without any other cranial nerve involvement narrows it further down to Brainstem CVA which was confirmed by the brain scans. The association of a hemiparesis, rubral tremor, or sensory loss with the cranial nerve palsy places the lesion in the midbrain.[7]

The lacunar infarct is over the medial longitudinal tract. The tract, which is formed of the fibres from the IIIrd, IVth, VIth and VIIIth cranial nerves, passing along the brainstem. The density of axons in the tract risks small infarcts causing significant neurological weakness.

The perfectly synchronous ocular movement is possible due to coordination of IInd, IIIrd, IVth and VIth cranial nerves and internuclear connections through MLF. MLF is a myelinated white matter tract made of neural fibres found on each side the brainstem, ventral to the periaqueductal grey matter. It contains the fibres linking the VIIIth cranial nerve (vestibulocochlear nerve) to the 3 cranial nerves supplying the extra-ocular muscles – IIIrd, IVth and VIth nerves. The fibres within the fasciculus provide connections between nuclei of the cranial nerves. The fibres connect the abducens nucleus with the contralateral oculomotor nucleus and vestibular nuclei to oculomotor and trochlear nuclei. These connections between the nuclei allow the horizontal conjugate lateral gaze, saccadic eye movements and the eye movements during the movement of the head and neck. This plays a vital role in the optokinetic/movement of the eyes and that of the head and also in vestibulo-ocular reflexes.[8]

The MLF infarct lesion in the midbrain or pons results in the ipsilateral medial rectus not receiving signal, thus impairment in ipsilateral adduction. This is due to the complex anatomy of MLF and related structures in the brainstem, which causes block in the connection between contralateral VIth nerve nucleus and the ipsilateral IIIrd nerve nucleus. The signal from the eye field for eye movement travels via VIth cranial nerve through its interneurons in MLF which connect to IIIrd cranial nerve nucleus that innervates medial rectus muscle. Thus, affecting the adduction movement of eyeball caused by medial rectus muscle.[3]

The involvement of MLF may be associated with infarction of cranial nerve nucleus resulting in respective nerve palsy. The cranial nerves supplying extra-ocular muscles, are prone for microvascular nerve palsy, which is considered when unilateral isolated pupil-sparing IIIrd, IVth or VIth nerve palsy occurs.[9] Microvascular nerve palsy has an incidence of about 1/100,000 due to the watersheds in the blood supply they receive.[9,10] This presentation of CVA with ocular medial rectus movement paralysis, could have been confused for IIIrd nerve nucleus infarct. The 3rd cranial nerve has central motor fibres and peripheral sensory/autonomic fibres. The motor fibres are supplied by the end arteries, so are prone for ischaemic events while the peripheral sensory nerves have better vascular supply and so comparatively less affected so commonly. The deeper motor nerves have watershed effect. These are more prone for the ischaemia and its effects. This can be more pronounced in people over 50 years (93%) diabetes (18%) and hypertension (25%).[11,12] Chau et al found that the presence of any common vascular risk factor, including diabetes mellitus, hypertension, hypercholesterolemia, or coronary artery disease, was significantly associated with

peripheral microvascular etiology of acute ocular motor mononeuropathies.[13] We believe that this patient suffering from DM and hypertension are the very high risk factors.

Internuclear ophthalmoplegia is a ocular movement disorder characterised by impairment in the ipsilateral eye adduction and nystagmus of contralateral eye due to lesion in the medial longitudinal fasciculus.[14] INO is relatively rare and the authors report in a series study that the incidence of 0.47% in all ischemic stroke patients.[15] About a third of the cases of INO are caused by infarctions in MLF, usually unilateral and seen in older people while about another third due to demyelinating disorders like multiple sclerosis, mostly bilateral and seen in young adults.[5,16]

This is a case of INO with an unusual presentation due to strategic location of infarct in the rostral midbrain, at brainstem-pontine junction, involving the MLF and can be diagnosed with diffusion weighted imaging (DWI).[17] The hallmark of the internuclear ophthalmoplegia is impaired orbital adduction to the affected MLF and this can range from mild limitation as in our case to severe restriction of adduction.[5]

Differentials include isolated partial IIIrd cranial nerve palsy, which is rare and could present with serious pathology.[18] According to Indraswari et al, it is uncommon for an isolated nuclear third cranial nerve stroke syndrome, so the clinician should look for neighboring signs for accurate clinical localization by a careful neurological examination.[18] This case could have been confused for the isolated IIIrd nerve palsy as the patient has presented with ocular movement impairment and no obvious nystagmus was observed, but on MRI imaging, the location of the infarct in MLF, inferior to the IIIrd nerve nucleus and may be possibly involving IVth nerve nucleus gives the possibility of INO. Also, there is no involvement of pupils, though the pupillary sparing in IIIrd nerve palsy is possible in more indolent causes like microvascular pathology of the inner vasa vasorum. pupil-sparing oculomotor palsies caused by intra-axial lesions are rare in the literature.[17]

For detecting intracranial anomalies, MRI is a more sensitive imaging technique than CT scan.[19] Acute ischemic lesions can be recognized as bright, high signal area on DWI and a corresponding dark, low signal area on the ADC map, which is a quantitative measure of water diffusion. Cranial nerve imaging is often performed using MRI in the axial plane at the level of the brainstem utilizing thin-section (0.7-mm sections) T2-weighted imaging. This image depicts the nerve as a dark linear structure in contrast to the high intensity signal from the surrounding cerebrospinal fluid (CSF).[20] On MRI, up to 75% of patients may have a visible lesion in MLF in patients with INO.[21]

The patients presenting with acute stroke symptoms and INO need hospitalization and further evaluation, as has been done in our case. The studies show that recovery from INO is more likely if isolated but less likely if there is visible lesion on MLF.[4,14] The authors, in their 30 case series of INO, found that INO eventually disappeared in all patients, tending to last longer when it was associated with other neurologic signs.[4]

CONCLUSION

In the absence of specific clinical signs like ocular-motor abnormalities, it is difficult to clinically locate the site of the lesion. MRI is more sensitive imaging technique for detecting intracranial anomalies. INO is rare, and this case demonstrates rare MLF infarct affecting the medial rectus muscle leading to INO. The presence of uncontrolled diabetes, hypertension and advanced age could all play a role in higher risk of vasculopathy in the patient presented. Good management of chronic illnesses could have prevented this incident.

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